HEATHKIT® MANUAL

HEATH COMPANY • BENTON HARBOR, MICHIGAN

HEATH COMPANY PHONE DIRECTORY

The following telephone numbers are direct lines to the departments listed:

Kit orders and delivery information ..... (616) 982-3411
Credit ..... (616) 982-3561
Replacement Parts ..... (616) 982-3571
Technical Assistance:
R/C, Audio, and Electronic Organs ..... (616) 982-3310
Amateur Radio ..... (616) 982-3296
Test Equipment, Strobe Lights, Calculators,
Clocks, Weather Instruments ..... (616) 982-3315
Television ..... (616) 982-3307
Automotive, Marine, Appliances,
Security, General Products ..... (616) 982-3496

YOUR HEATHKIT 90-DAY FULL WARRANTY

If you are not satisfied with our service - warranty or otherwise - or with our products, write directly to our Director of Customer Services, Heath Company, Benton Harbor, Michigan 49022. He will make certain your problems receive immediate, personal attention.

Our attorney, who happens to be quite a kitbuilder himself, insists that we describe our warranty using all the necessary legal phrases in order to comply with the new warranty regulations. Fine. Here they are:

For a period of ninety (90) days after purchase, Heath Company will replace or repair free of charge any parts that are defective either in materials or workmanship. You can obtain parts directly from Heath Company by writing us at the address below or by telephoning us at (616) 982-3571. And we'll pay shipping charges to get those parts to you — anywhere in the world.

We warrant that during the first ninety (90) days after purchase, our products, when correctly assembled, calibrated, adjusted and used in accordance with our printed instructions, will meet published specifications.

If a defective part or error in design has caused your Heathkit product to malfunction during the warranty period through no fault of yours, we will service it free upon proof of purchase and delivery at your expense to the Heath factory, any Heathkit Electronic Center (units of Schlumberger Products Corporation), or any of our authorized overseas distributors.

You will receive free consultation on any problem you might encounter in the assembly or use of your Heathkit product. Just drop us a line or give us a call. Sorry, we cannot accept collect calls.

Our warranty does not cover and we are not responsible for damage caused by the use of corrosive solder, defective tools, incorrect assembly, misuse, fire, or by unauthorized modifications to or uses of our products for purposes other than as advertised. Our warranty does not include reimbursement for customer assembly or set-up time.

This warranty covers only Heathkit products and is not extended to allied equipment or components used in conjunction with our products. **We are not responsible for incidental or consequential damages.** Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

HEATH COMPANY
BENTON HARBOR, MI. 49022

Prices and specifications subject to change without notice.

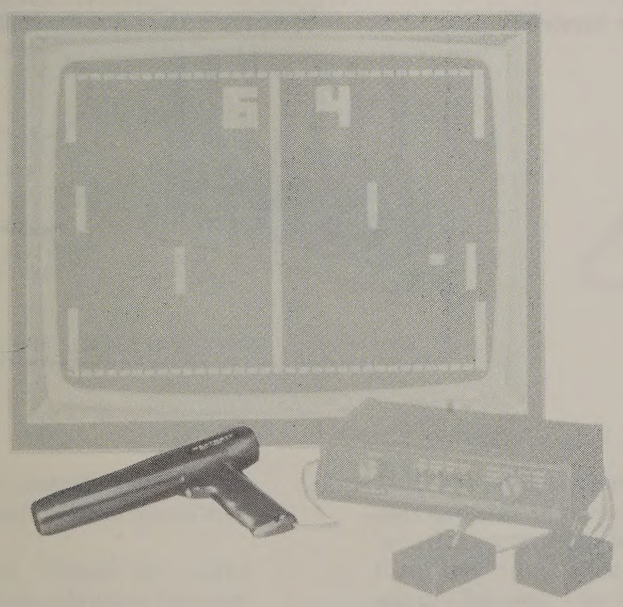
Heathkit® Manual

for the

TARGET ACCESSORY

Model GDA-1380-1

595-2007-1



HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

Copyright © 1977
Heath Company
All Rights Reserved
Printed in the United States of America

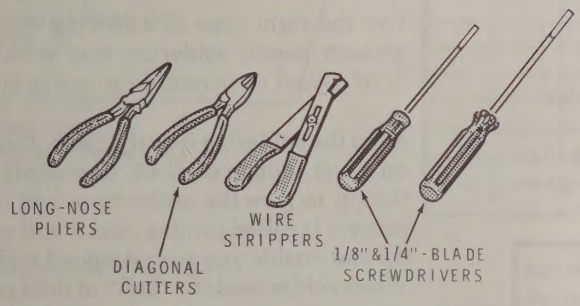
TABLE OF CONTENTS

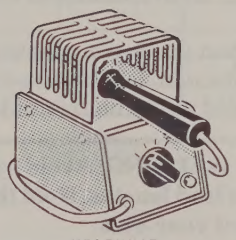
Assembly Notes 3
Parts List 6
Step-by-Step Assembly
  Circuit Board Assembly 8
  Component Housing Assembly 14
Installation 16
Initial Tests and Adjustments
  IC Installation 18
  Resistance Test 19
  LDR Adjustment 20
Final Assembly 21
Operation 22
In Case of Difficulty 23
  Troubleshooting Charts 24
Specifications 26
Circuit Description 27
Circuit Board X-Ray View 29
Semiconductor Identification Charts 30
Schematic 31
Warranty ..... Inside front cover
Customer Service ..... Inside rear cover

ASSEMBLY NOTES

TOOLS

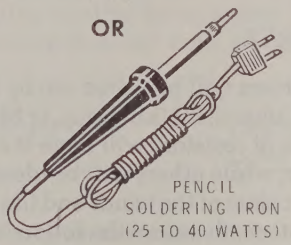
You will need these tools to assemble your kit.





HEATHKIT SOLDERING IRON

OR

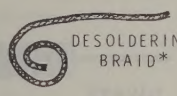


PENCIL SOLDERING IRON (25 TO 40 WATTS)

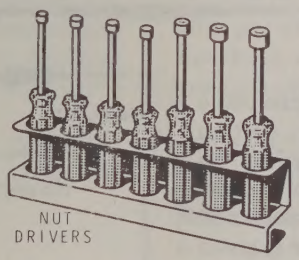
OTHER HELPFUL TOOLS

DESOLDERING BULB*

NUT STARTER (MAY BE SUPPLIED WITH KIT)



DESOLDERING BRAID*



NUT DRIVERS

*TO REMOVE SOLDER FROM CIRCUIT CONNECTIONS.

ASSEMBLY

1. Follow the instructions carefully and read the entire step before you perform the operation.

2. The illustrations in the Manual are called Pictorials and Details. Pictorials show the overall operation for a group of assembly steps; Details generally illustrate a single step. When you are directed to refer to a certain Pictorial "for the following steps," continue using that Pictorial until you are referred to another Pictorial for another group of steps.

3. Most kits use a separate "Illustration Booklet" that contains illustrations (Pictorials, Details, etc.) that are too large for the Assembly Manual. Keep the "Illustration Booklet" with the Assembly Manual. The illustrations in it are arranged in Pictorial number sequence.

4. Position all parts as shown in the Pictorials.

5. Solder a part or a group of parts only when you are instructed to do so.

6. Each circuit part in an electronic kit has its own component number (R2, C4, etc.). Use these numbers when you want to identify the same part in the various sections of the Manual. These numbers, which are especially useful if a part has to be replaced, appear:

   — In the Parts List,

   — At the beginning of each step where a component is installed,

   — In some illustrations,

   — In the Schematic,

   — In the section at the rear of the Manual.

7. When you are instructed to cut something to a particular length, use the scales (rulers) provided at the bottom of the Manual pages.

SAFETY WARNING: Avoid eye injury when you cut off excess lead lengths. Hold the leads so they cannot fly toward your eyes.

SOLDERING

Soldering is one of the most important operations you will perform while assembling your kit. A good solder connection will form an electrical connection between two parts, such as a component lead and a circuit board foil. A bad solder connection could prevent an otherwise well-assembled kit from operating properly.

It is easy to make a good solder connection if you follow a few simple rules:

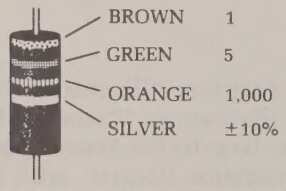
1. Use the right type of soldering iron. A 25 to 40-watt pencil soldering iron with a 1/8" or 3/16" chisel or pyramid tip works best.

2. Keep the soldering iron tip clean. Wipe it often on a wet sponge or cloth; then apply solder to the tip to give the entire tip a wet look. This process is called tinning, and it will protect the tip and enable you to make good connections. When solder tends to "ball" or does not stick to the tip, the tip needs to be cleaned and retinned.

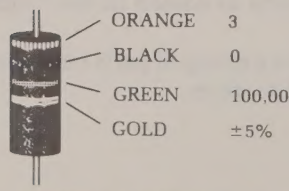
PARTS

Resistors will be called out by their resistance value in Ω (ohms), kΩ (kilohms), or MΩ (megohms). Certain types of resistors will have the value printed on the body, while others will be identified by a color code. The colors of the bands and the value will be given in the steps, therefore the following color code is given for information only.

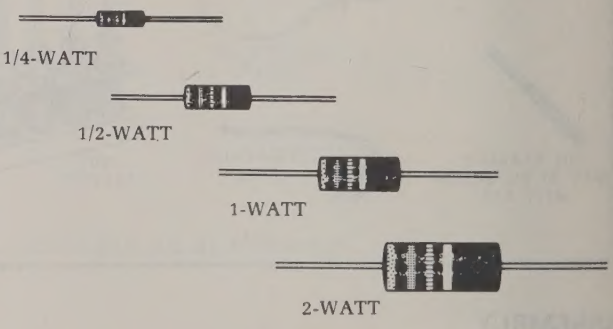
EXAMPLES:



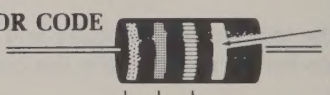
15 × 1,000 = 15,000 Ω (15,000 OHMS), or "15 kΩ"



30 × 100,000 = 3,000,000 Ω (or 3 MΩ)
3 MΩ = 3 MEGOHMS



RESISTOR COLOR CODE



COLOR	1st DIGIT	2nd DIGIT	MULTIPLY BY
BLACK	0	0	1
BROWN	1	1	10
RED	2	2	100
ORANGE	3	3	1,000
YELLOW	4	4	10,000
GREEN	5	5	100,000
BLUE	6	6	1,000,000
VIOLET	7	7	10,000,000
GRAY	8	8	100,000,000
WHITE	9	9	1,000,000,000
GOLD			.1
SILVER			.01

Capacitors will be called out by their capacitance value in μF (microfarads) or pF (picofarads) and type: ceramic, Mylar*, electrolytic, etc. Some capacitors may have their value printed in the following manner:

First digit of capacitor's value: 1

Second digit of capacitor's value: 5

Multiplier: Multiply the first & second digits by the proper value from the Multiplier Chart.

To find the tolerance of the capacitor, look up this letter in the Tolerance columns.

EXAMPLES:

151K = 15 × 10 = 150 pF
759 = 75 × 0.1 = 7.5 pF

NOTE: The letter "R" may be used at times to signify a decimal point; as in: 2R2 = 2.2 (pF or μF).

MULTIPLIER		TOLERANCE OF CAPACITOR		
FOR THE NUMBER:	MULTIPLY BY:	10pF OR LESS	LETTER	OVER 10pF
0	1	±0.1pF	B	
1	10	±0.25pF	C	
2	100	±0.5pF	D	
3	1000	±1.0pF	F	±1%
4	10,000	±2.0pF	G	±2%
5	100,000		H	±3%
			J	±5%
8	0.01		K	±10%
9	0.1		M	±20%

*DuPont Registered Trademark

PARTS LIST

Open the shipping carton and check the parts against the following list. The key numbers below correspond to the numbers on the Parts Pictorial. Any part that is packed in an individual envelope with a part number on it should be placed back in the envelope after you identify it until it is called for in a step. Do not throw away any packing material until all parts are accounted for.

RESISTORS

1/2-Watt

NOTES:

1. The resistors may be packed in more than one envelope. Open all the resistor envelopes before you check the resistors against the Parts List.
2. The following resistors have a tolerance of 10% unless they are listed otherwise. 10% is indicated by a fourth band of silver, while 5% is indicated by a gold fourth band.

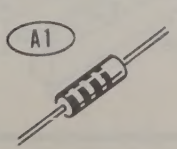
KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
A1	1-44	1	2200 Ω (red-red-red)	R9
A1	1-64	3	5100 Ω, 5% (green-brown-red)	R10, R13, R14
A1	1-20	1	10 kΩ (brown-black-orange)	R8
A1	1-65	1	51 kΩ, 5% (green-brown-orange)	R4
A1	1-60	1	68 kΩ (blue-gray-orange)	R16

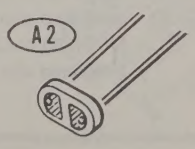
Resistors (cont'd.)

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
A1	1-142	1	560 kΩ (green-blue-yellow)	R12
A1	1-27	1	150 kΩ (brown-green-yellow)	R5
A1	1-29	1	220 kΩ (red-red-yellow)	R15
A1	1-32	2	390 kΩ (orange-white-yellow)	R1, R11
A1	1-35	2	1 MΩ (brown-black-green)	R2, R6
A1	1-36	1	1.5 MΩ (brown-green-green)	R7
A1	1-37	1	2.2 MΩ (red-red-green)	R3

Other Resistor

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
A2	9-67	1	133 kΩ LDR (light dependent resistor)	LDR1





CAPACITORS

Electrolytic

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
B1	25-117	1	100 μF	C7

Tantalum

B2	25-221	1	2.2 μF	C2

Mylar

B3	27-74	2	.01 μF	C1, C3
B3	27-47	3	.1 μF	C4, C5, C6

DIODES — TRANSISTORS — INTEGRATED CIRCUITS

C1	56-56	5	1N4149 diode	D1, D2, D3, D4, D3*

NOTE: Transistors and integrated circuits are marked for identification in one of the following four ways:

1. Part number.
2. Type number. (On most integrated circuits, this refers only to the numbers; the letters may be different or missing.)
3. Part number and type number.
4. Part number with a type number other than the one shown.

C2	417-801	1	MPSA20 transistor	Q3
C2	417-881	2	MPSA13 transistor	Q1, Q2

CAUTION: The following integrated circuits can be damaged by static electricity. Do not remove them from their carriers until you are instructed to do so in a step.

C3	443-777	1	MC14528 or CD4098 integrated circuit	IC1
C3	443-778	1	MC14093 or CD4093 integrated circuit	IC2

*This diode will be installed in the Video Game.

HARDWARE

#4 Hardware

KEY No.	HEATH Part No.	QTY.	DESCRIPTION	CIRCUIT Comp. No.
D1	250-186	4	#4 × 3/8- self-tapping screw	

#6 Hardware

D2	250-381	1	6-32 × 3/8" black screw	
D3	250-559	5	#6 × 5/8" self-tapping screw	
D4	252-3	1	6-32 nut	
D5	254-1	1	#6 lockwasher	

3/8" Hardware

D6	252-7	1	3/8" nut	
D7	253-10	1	3/8" flat washer	
D8	254-5	1	3/8" lockwasher	

MISCELLANEOUS

E1	64-848	1	Pushbutton switch	SW1
E2	73-4	1	Grommet	
	85-1979-2	1	Circuit board	
E3	207-5	1	Cable clamp	
	214-183	1	Housing	
			Consisting of:	
E4		*1*	*Housing half (component)*	
E5		*1*	*Housing half (cover)*	
	347-7	10′	4-wire cable	
E6	390-1373	2	Kit model label	
	391-34	1	Blue and white label	
E7	413-30	1	Lens	
E8	432-267	1	14-pin IC socket	
E9	434-268	1	16-pin IC socket	
	597-260	1	Parts Order Form	
		1	Assembly Manual (See Page 1 for part number.)	
			Solder	

To order a replacement part, always include the PART NUMBER. Use the Parts Order Form furnished with this kit or at the rear of this Manual. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover. Your Warranty is inside the front cover. For prices, refer to the separate "Heath Parts Price List."

PARTS PICTORIAL

STEP-BY-STEP ASSEMBLY

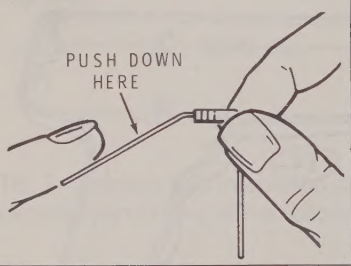
CIRCUIT BOARD ASSEMBLY

START

In the following steps you will be given detailed instructions on how to install and solder the first part on the circuit board. Read and perform each step carefully. Then use the same procedure whenever you install parts on a circuit board.

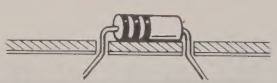
( ) Position the circuit board as shown with the printed side (not the foil side) up.

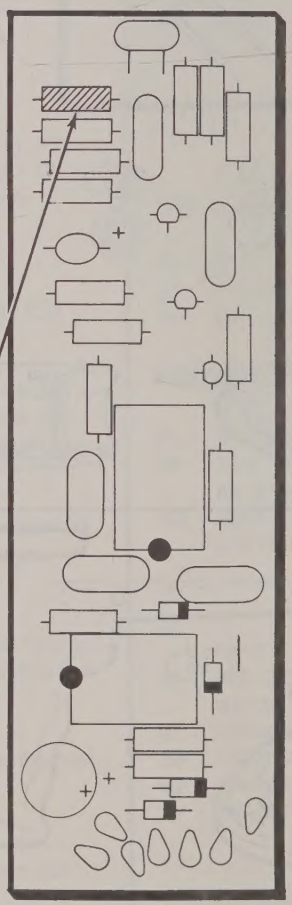
( ) R1: Hold a 390 kΩ (orange-white-yellow) resistor by the body, as shown, and bend the leads straight down.



( ) Push the leads through the holes at the indicated location on the circuit board. The end with the color bands may be positioned either way.

( ) Press the resistor against the circuit board. Then bend the leads outward slightly to hold the resistor in place.



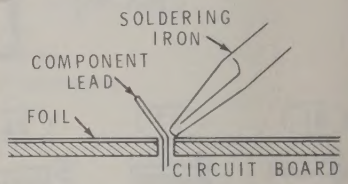


PICTORIAL 1-1

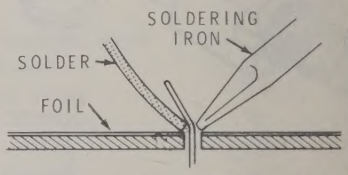
CONTINUE

( ) Solder the resistor leads to the circuit board as follows:

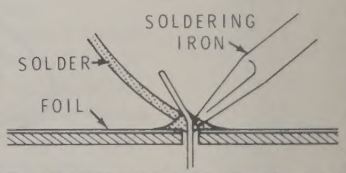
1. Push the soldering iron tip against both the lead and the circuit board foil. Heat **both** for two or three seconds.



2. Then apply solder to the other side of the connection. IMPORTANT: Let the heated lead and the circuit board foil melt the solder.



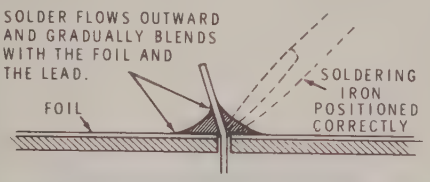
3. As the solder begins to melt, allow it to flow around the connection. Then remove the solder and the iron and let the connection cool.



( ) Cut off the excess lead lengths close to the connection. WARNING: Clip the leads so the ends will not fly toward your eyes.

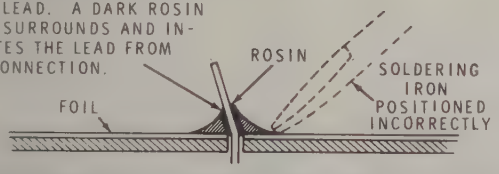
( ) Check each connection. Compare it to the illustrations on Page 9. After you have checked the solder connections, proceed with the assembly on Page 10. Use the same soldering procedure for each connection.

A GOOD SOLDER CONNECTION

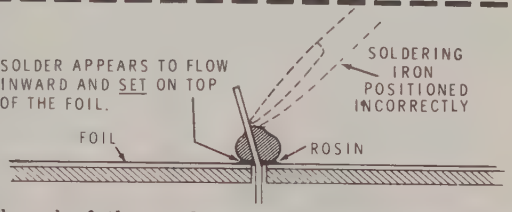


When you heat the lead and the circuit board foil at the same time, the solder will flow evenly onto the lead and the foil. The solder will make a good electrical connection between the lead and the foil.

POOR SOLDER CONNECTIONS


SOLDER DOES NOT FLOW ONTO LEAD. A DARK ROSIN BEAD SURROUNDS AND INSULATES THE LEAD FROM THE CONNECTION.
ROSIN
FOIL
SOLDERING IRON POSITIONED INCORRECTLY

When the lead is not heated sufficiently, the solder will not flow onto the lead as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.



When the foil is not heated sufficiently the solder will blob on the circuit board as shown above. To correct, reheat the connection and, if necessary, apply a small amount of additional solder to obtain a good connection.

SOLDER BRIDGES

A solder bridge between two adjacent foils is shown in photograph **A**. Photograph **B** shows how the connection should appear. A solder bridge may occur if you accidentally touch an adjacent previously soldered connection, if you use too much solder, or if you "drag" the soldering iron across other foils as you remove it from the connection. A good rule to follow is; always take a good look at the foil area around each lead before you solder it. Then, when you solder the connection, make sure the solder remains in this area and does not bridge to another foil. This is especially important when the foils are small and close together. NOTE: It is alright for solder to bridge two connections on the same foil.

A

SOLDER BRIDGE

Use only enough solder to make a good connection, and lift the soldering iron straight up from the circuit board. If a solder bridge should develop, turn the circuit board foil-side-down and heat the solder between connections. The excess solder will run onto the tip of the soldering iron, and this will remove the solder bridge. NOTE: The foil side of each circuit board has a coating on it called "solder resist." This is a protective insulation to help prevent solder bridges.

B

START

( ) R2: 1 MΩ (brown-black-green).

( ) R3: 2.2 MΩ (red-red-green).

( ) R4: 51 kΩ (green-brown-orange).

( ) R8: 10 kΩ (brown-black-orange).

( ) R9: 2200 Ω (red-red-red).

( ) Solder the leads to the foil and cut off the excess lead lengths.

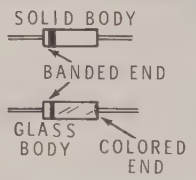
( ) R11: 390 kΩ (orange-white-yellow).

( ) R12: 560 kΩ (green-blue-yellow).

( ) R13: 5100 Ω (green-brown-red).

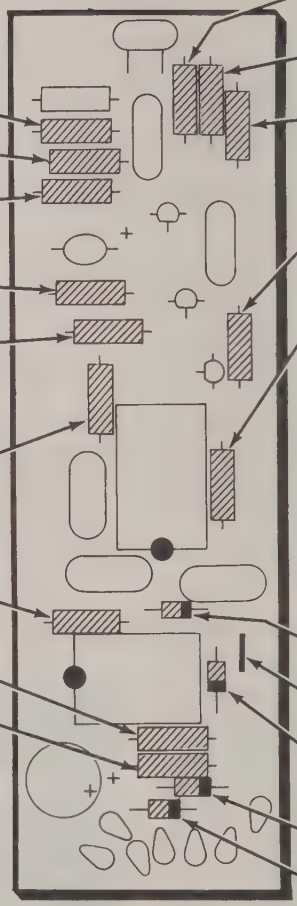
( ) R14: 5100 Ω (green-brown-red).

( ) Solder the leads to the foil and cut off the excess lead lengths.



If your diode has a solid body, the band is clearly defined. If your diode has a glass body, do not mistake the colored end **inside** the diode for the banded end. Look for a band painted on the **outside** of the glass.

Detail 1-2A



PICTORIAL 1-2

CONTINUE

( ) R5: 150 kΩ (brown-green-yellow).

( ) R7: 1.5 MΩ (brown-green-green).

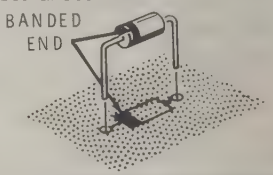
( ) R6: 1 MΩ (brown-black-green).

( ) R10: 5100 Ω (green-brown-red).

( ) R15: 220 kΩ (red-red-yellow).

( ) Solder the leads to the foil and cut off the excess lead lengths. Save one cut off resistor lead for use later.

NOTE: When you install a diode, always match the banded end of the diode with the band mark on the circuit board. See Detail 1-2A.



( ) D1: 1N4149 diode (#56-56).

( ) Bare wire. Use the resistor lead you saved earlier.

( ) D2: 1N4149 diode (#56-56).

( ) D3: 1N4149 diode (#56-56).

( ) D4: 1N4149 diode (#56-56).

( ) Solder the leads to the foil and cut off the excess lead lengths.

START

( ) Reposition the circuit board as shown.

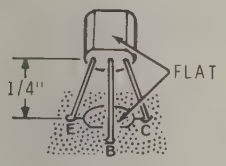
NOTE: The following IC socket can be correctly installed in only one direction. Be sure the pins are straight before you mount it; and then be sure all the pins are through the circuit board before you begin to solder the pins to the foil.

( ) 14-pin IC socket at IC2.

NOTE: The following IC socket can be correctly installed in either direction. Be sure the socket pins are straight, and then be sure all of them go through the circuit board before you begin to solder the pins to the foil.

( ) 16-pin IC socket at IC1.

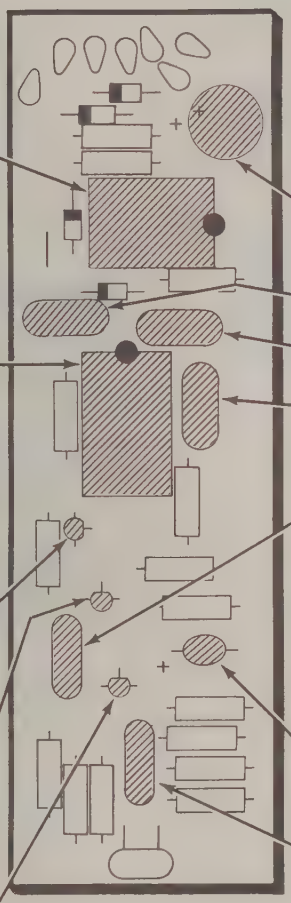
NOTE: When you install each of the following transistors, line up the flat on the transistor with the outline of the flat on the circuit board. Then insert the E, B, and C leads of the transistor into the corresponding E, B, and C holes in the circuit board. Position the transistor 1/4" above the circuit board. Solder the leads to the foil and cut off the excess lead lengths.



( ) Q3: MPSA20 transistor (#417-801).

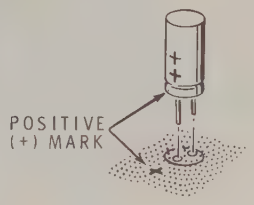
( ) Q2: MPSA13 transistor (#417-881).

( ) Q1: MPSA13 transistor (#417-881).



CONTINUE

NOTE: When you install the following electrolytic capacitor, be sure you match the positive (+) marking on the capacitor with the positive (+) marking on the circuit board.



( ) C7: 100 μF electrolytic.

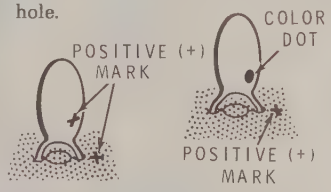
( ) C5: .1 μF Mylar.

( ) C6: .1 μF Mylar.

( ) C4: .1 μF Mylar.

( ) C3: .01 μF Mylar.

NOTE: When you install a tantalum capacitor, always position the positive (+) or dot marked lead of the capacitor in the positive (+) marked hole.



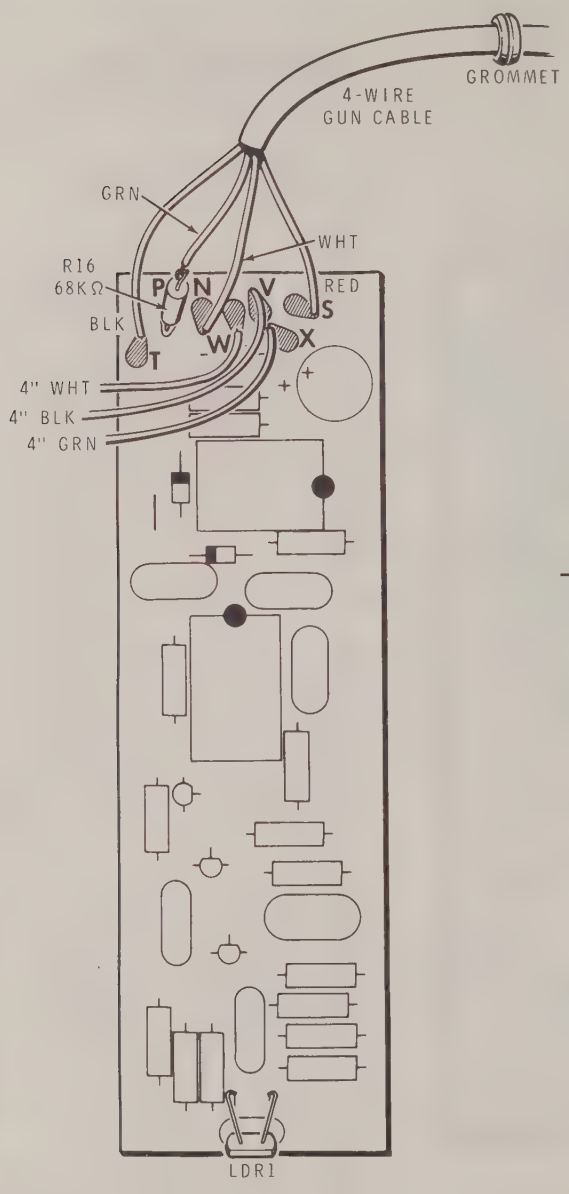
( ) C2: 2.2 μF tantalum.

( ) C1: .01 μF Mylar.

( ) Solder the leads to the foil and cut off the excess lead lengths.

NOTE: The integrated circuits, LDR, and remaining diode will be installed later.

PICTORIAL 1-3

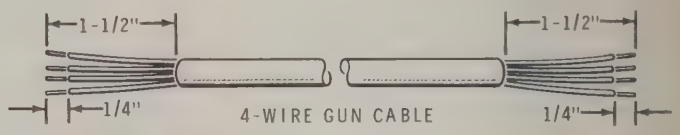


PICTORIAL 1-4

Refer to Pictorial 1-4 for the following steps.

( ) Remove 4" of outer insulation from the 4-wire cable. Then cut off the four wires where they leave the outer insulation. Lay the white, black, and green wires aside for use later. The red wire may be discarded.

( ) Refer to Detail 1-4A and prepare the remaining length of 4-wire cable as shown. Then twist the fine wire strands together at the end of each wire and melt a small amount of solder on each end to hold the fine strands together. In the future, this cable will be referred to as the 4-wire gun cable.



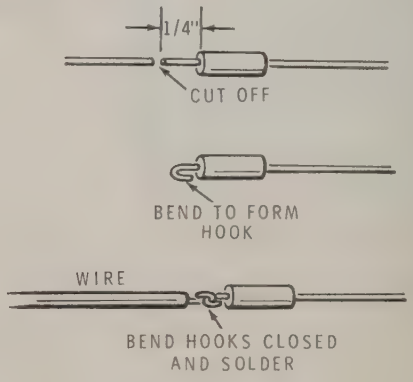
Detail 1-4A

( ) Install the grommet on either end of the 4-wire gun cable. Slide the grommet approximately 6" onto the cable.

( ) Refer to Detail 1-4B and cut one lead of a 68 kΩ (blue-gray-orange) resistor to 1/4". Then bend this lead to form a hook.

( ) At the end of the cable with the grommet, bend a hook in the end of the green wire of the 4-wire gun cable.

( ) Refer to Detail 1-4B and hook the green wire into the hook on the 68 kΩ resistor. Bend the hooks closed and solder the connection.



Detail 1-4B

NOTE: Solder each wire and the resistor lead to the foil as you install it in all of the following wiring steps.

Connect the wires from the 4-wire gun cable end with the grommet to the circuit board as follows:

( ) Black to hole T.

( ) R16: 68 kΩ resistor to hole P.

( ) White to hole N.

( ) Red to hole S.

The free end of the 4-wire gun cable will be connected later.

NOTE: To prepare wires, remove 1/4″ of insulation from each end. Then twist the fine wire strands together and melt a minimum amount of solder on each end to hold the fine wire strands together.

( ) Prepare the 4″ white, black, and green wires laid aside earlier.

( ) Connect either end of the 4″ white wire to circuit board hole W. The free end of the wire will be connected later.

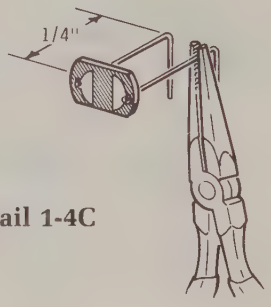
( ) Connect either end of the 4″ black wire to circuit board hole V. The free end of this wire will be connected later.

( ) Connect either end of the 4″ green wire to circuit board hole X. The free end of this wire will be connected later.

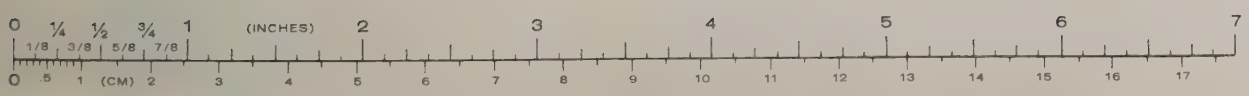
NOTE: In the following steps, DO NOT touch the "face" of the LDR.

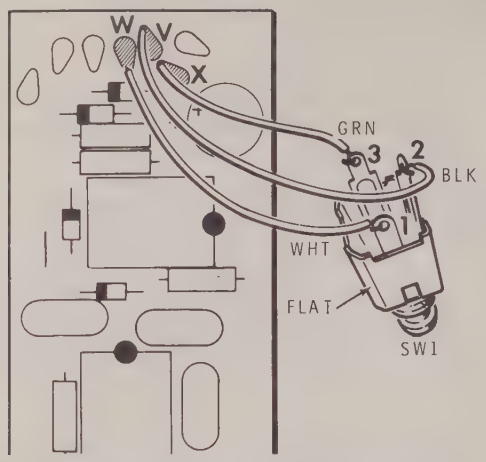
( ) Refer to Detail 1-4C and bend the LDR leads 1/4″ from the LDR body as shown. Hold the LDR leads with pliers to bend the leads. DO NOT hold the LDR by the body.

( ) LDR1: Mount the LDR to the circuit board at LDR1. Position the bottom edge of the LDR approximately 1/8″ above the circuit board. Solder the leads to the foil and cut off the excess lead lengths.



Detail 1-4C





PICTORIAL 1-5

Refer to Pictorial 1-5 for the following steps.

( ) Position pushbutton switch SW1 near the circuit board as shown. Note the position of the flat on the switch.

NOTE: In the following steps, solder the wires to the switch lugs as you connect them.

Connect the free end of the three circuit board wires to switch SW1 as follows:

( ) White to lug 1.

( ) Black to lug 2.

( ) Green to lug 3.

CIRCUIT BOARD CHECKOUT

Carefully inspect the circuit board for the following conditions.

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foils.

( ) Protruding leads which could touch together.

( ) Transistors and diodes for proper type and installation.

( ) Electrolytic capacitors for the correct position of the positive (+) end.

COMPONENT HOUSING ASSEMBLY

Refer to Pictorial 2-1 for the following steps.

( ) Position the component half of the housing as shown.

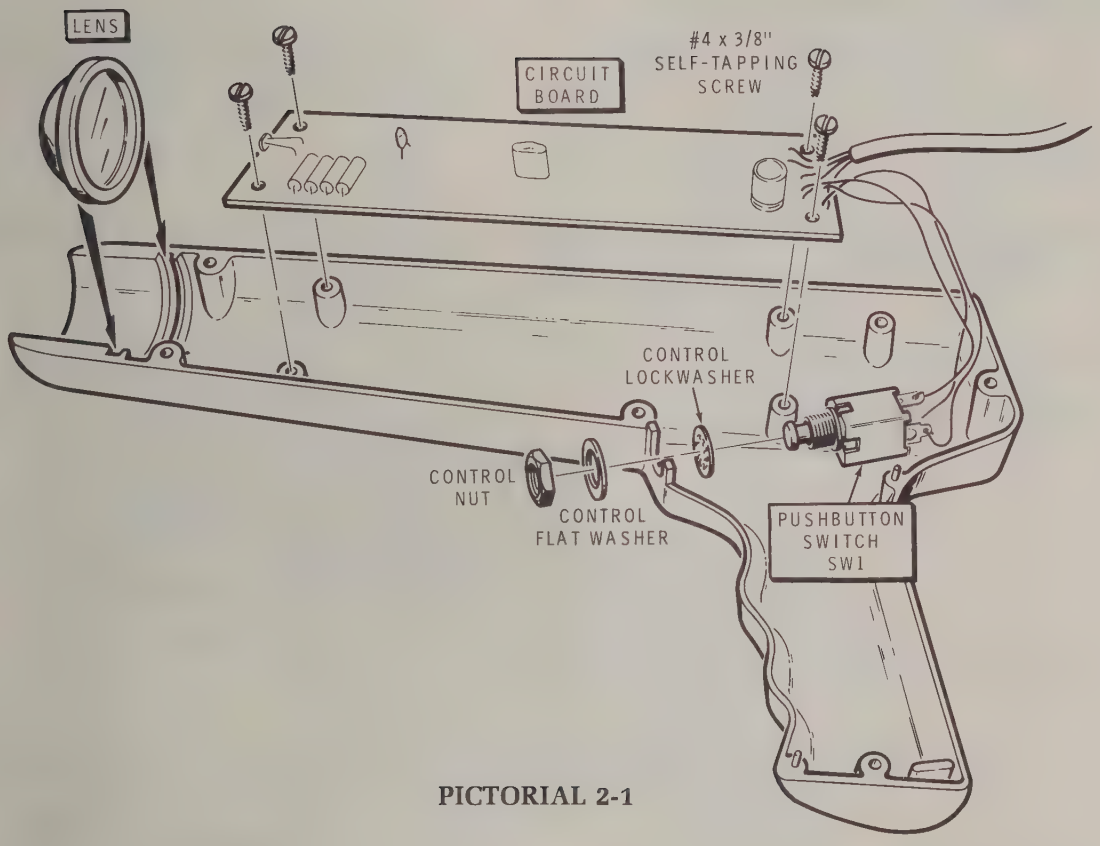
( ) Mount the circuit board to the component half of the housing as shown. Use four #4 × 3/8" self-tapping screws. DO NOT overtighten these screws.

( ) Place a control lockwasher, control flat washer, and control nut on pushbutton switch SW1. Position them so the nut and flat washer will be on the outside of the housing and the lockwasher will be on the inside of the housing when the switch is installed in the next step.

( ) SW1: Slide pushbutton switch SW1 into the cutout on the housing at SW1 as shown. Then carefully tighten the control nut to hold the switch to the housing.

( ) Place the lens in the component half of the housing with the flat side of the lens facing the circuit board.

This completes the assembly of the component housing. The integrated circuits will be installed later. Lay the housing assembly aside until it is called for later. Proceed to the "Installation" section of the Manual.



PICTORIAL 2-1

INSTALLATION

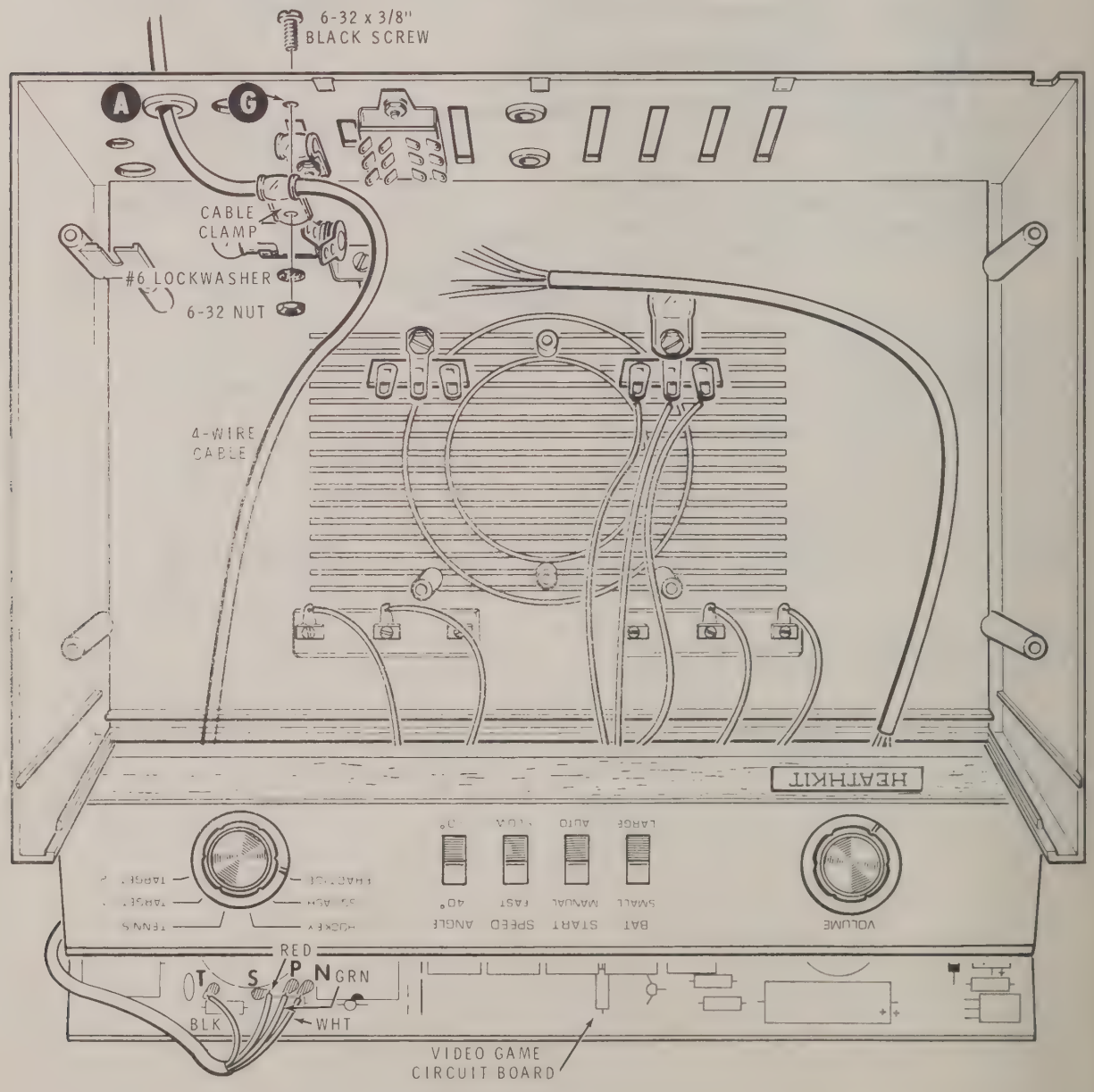
In this section of the Manual, you will connect your Target Accessory to your Video Game.

Refer to Pictorial 3-1 for the following steps.

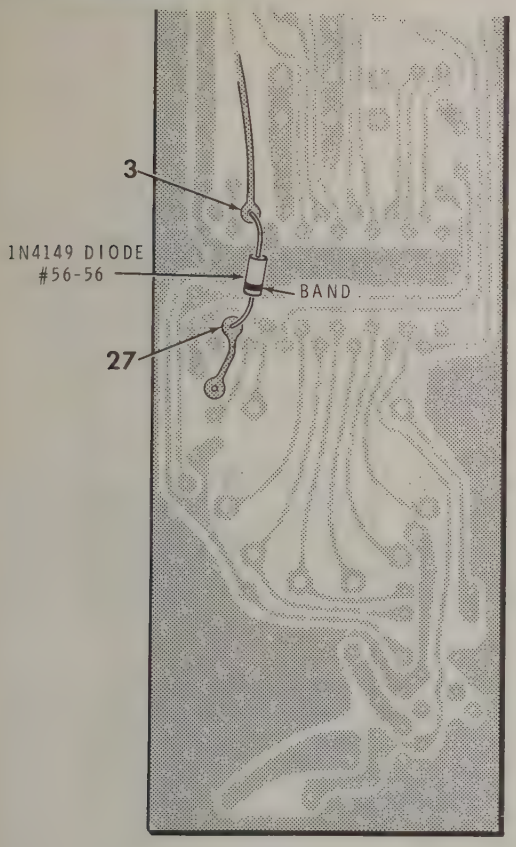
( ) Locate your Video Game and remove the cabinet bottom by removing the four #6 × 2-1/4" black self-tapping screws.

( ) Carefully cut a hole in the switch label at G. Be sure to cut the label at the small hole in the cabinet back just above the cable clamp.

( ) Cut both leads of a 1N4149 diode (#56-56) 1/2" from where they leave the diode body.



PICTORIAL 3-1



Detail 3-1A

Refer to Detail 3-1A for the next three steps.

( ) 1. Remove the orange wire from the foil side of the Video Game circuit board.

( ) 2. D3: Connect and solder the lead at the UNBANDED end of the 1N4149 diode (#56-56) to the indicated foil (pin 3 of IC2) of the Video Game circuit board. Be careful you do not bridge solder to other nearby foils.

( ) 3. D3: Connect and solder the lead at the BANDED end of the 1N4149 diode to the indicated foil (pin 27 of IC2) of the Video Game circuit board. Be careful you do not bridge solder to other nearby foils.

( ) Locate your Target Accessory housing assembly.

( ) Route the 4-wire gun cable through grommet A and a cable clamp to the Video Game circuit board as shown.

( ) Mount the cable clamp to the cabinet back at G as shown. Use a 6-32 × 3/8" black screw, a #6 lockwasher, and a 6-32 nut.

NOTES:

1. If you encounter difficulty installing the following wires to the Video Game circuit board, you may want to remove the front panel.

2. In the following steps, solder each wire to the foil as you install it.

Connect the wires from the 4-wire cable to the Video Game circuit board as follows:

( ) Black to hole T.

( ) Red to hole S.

( ) Green to hole P.

( ) White to hole N.

Carefully inspect the Video Game circuit board for the following conditions:

( ) Unsoldered connections.

( ) Poor solder connections.

( ) Solder bridges between foil patterns.

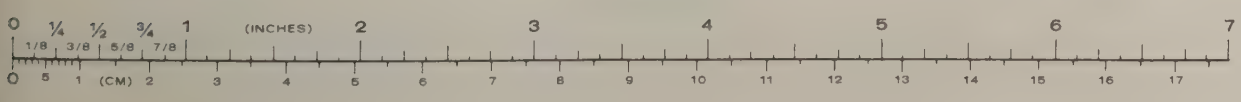
( ) Protruding leads which could touch together.

( ) Diode for the correct position of the banded end.

( ) Reinstall the Video Game's circuit board and front panel.

( ) Reinstall the Video Game's cabinet bottom to the cabinet top.

This completes the "Installation." Proceed to the "Initial Test and Adjustment."



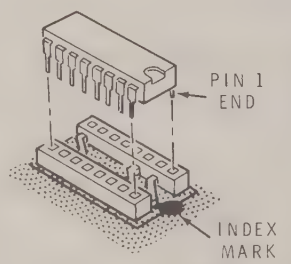
INITIAL TEST AND ADJUSTMENT

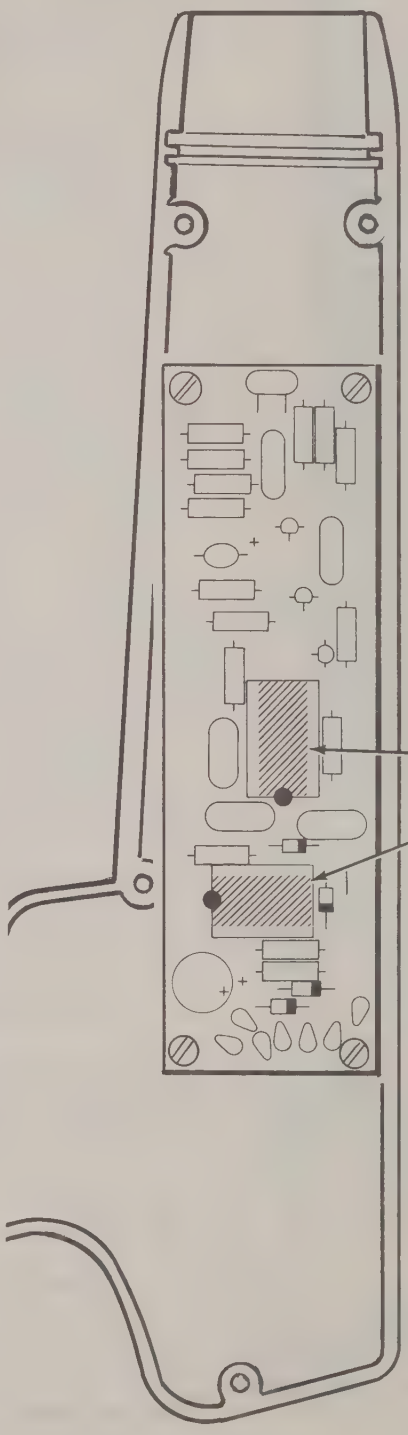
IC INSTALLATION

START

NOTE: The integrated circuits that you will install in the next steps are rugged and reliable components. However, normal static electricity discharged from your body, through an integrated circuit pin to an object, can damage the integrated circuits. Read the instructions first. Then carefully perform each step without interruption.

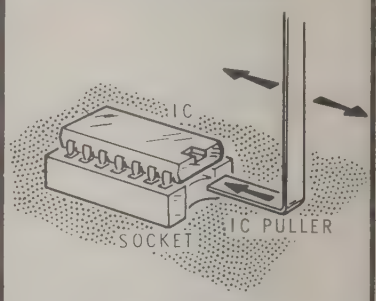
1. Remove the IC from its package, with both hands.
2. Hold the IC in one hand, remove the conductive foam, and straighten any bent pins with the other hand.
3. Continue holding the IC, being careful not to touch it to anything, while you pick up and hold the housing assembly in your hand.
4. Align the pin 1 end of the IC with socket pin 1. See Detail 4-1A. Carefully start the IC pins into the socket; then push down on the IC. Once the IC is inserted into the socket it is protected against static electricity.





CONTINUE

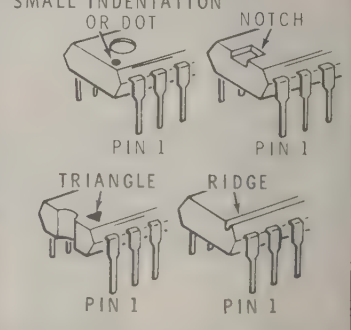
NOTE: Use the IC puller furnished with your Video Game to remove an IC from its socket if necessary.



Push the shorter end of the puller in between the IC and the socket and rock the long portion back and forth. Be very careful as the IC pins are very easily bent.

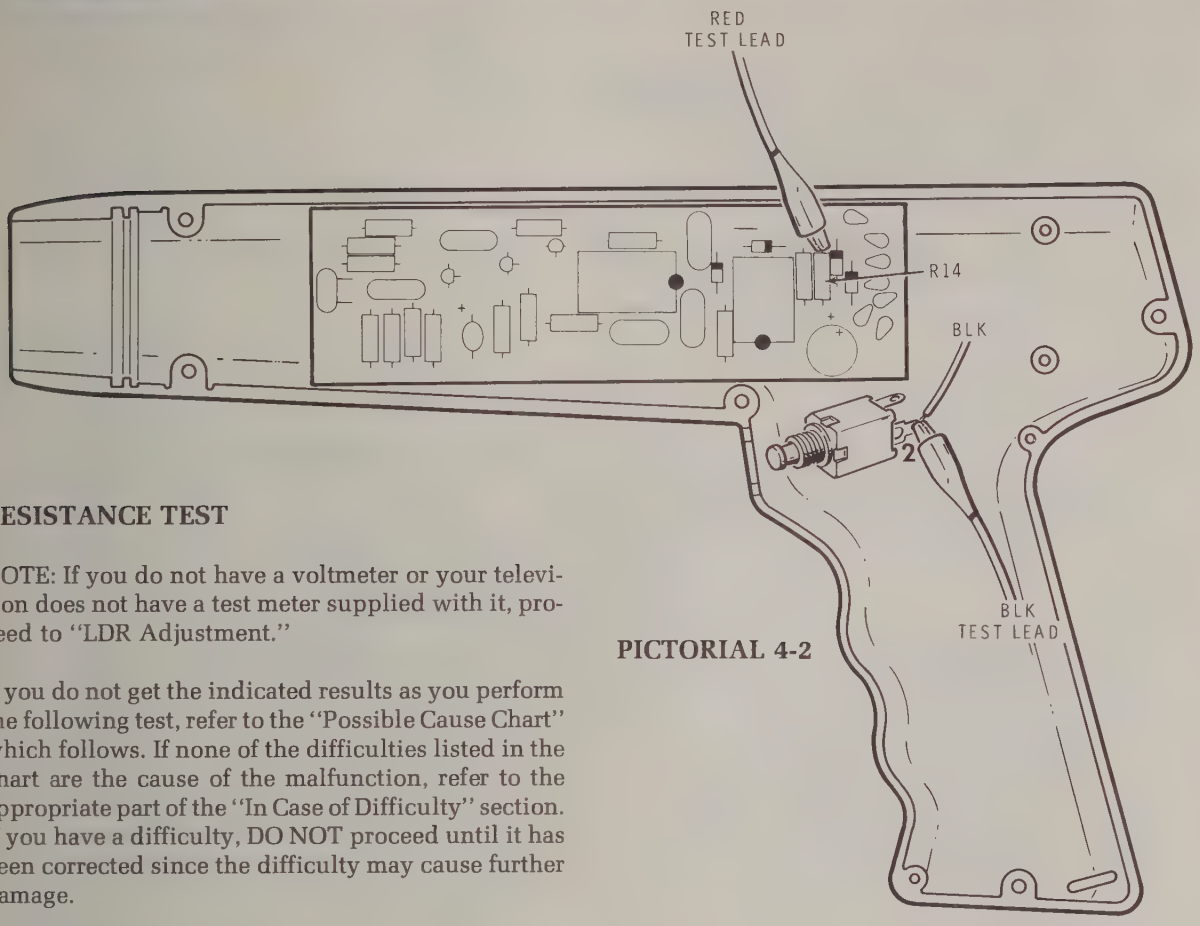
( ) IC1: MC14528/CD4098 integrated circuit (#443-777).

( ) IC2: MC14093/CD4093 integrated circuit (#443-778).



Detail 4-1A

PICTORIAL 4-1



PICTORIAL 4-2

RESISTANCE TEST

NOTE: If you do not have a voltmeter or your television does not have a test meter supplied with it, proceed to "LDR Adjustment."

If you do not get the indicated results as you perform the following test, refer to the "Possible Cause Chart" which follows. If none of the difficulties listed in the chart are the cause of the malfunction, refer to the appropriate part of the "In Case of Difficulty" section. If you have a difficulty, DO NOT proceed until it has been corrected since the difficulty may cause further damage.

Refer to Pictorial 4-2 for the following steps.

NOTE: The following meter switch positions are for the test meter supplied with most Heathkit televisions.

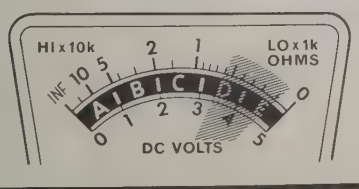
Set the test meter switches as follows:

( ) FUNCTION switch — OHMS HI position.

( ) VOLT RANGE switch — Any position.

( ) Connect the black test lead to SW1 lug 2.

( ) Connect the red test lead to the indicated lead of resistor R14. Your meter indication should be approximately 3000 Ω as shown below.

METER INDICATION	POSSIBLE CAUSE CHART
	1. 4-WIRE GUN CABLE WIRED INCORRECTLY. 2. SOLDER BRIDGE. 3. C3. 4. IC1 OR IC2.

( ) Disconnect the red and black test leads.

LDR ADJUSTMENT

NOTE: The sensitivity of the LDR is reduced in bright ambient light. Therefore, perform the following steps in a dimly lit room for greater sensitivity. Turn on your television and Video Game and adjust your television's brightness control for a dark background.

Set your Video Game's Selector switch as follows:

( ) Rotate the Selector switch to the Target 1 position.

( ) Touch the Reset touchplate.

( ) Rotate the Selector switch to the Target 2 position. The score should be displayed on the screen. DO NOT touch the Reset touchplate.

In the following steps, use the score display to adjust the LDR.

( ) Place the cover housing on the component housing. DO NOT install any of the screws at this time. The cover housing is only used to shield the LDR from ambient light at this time.

( ) Keep the gun approximately three feet from your television screen and shoot at the score display. You should hear a "hit" tone generated each time you hit the score.

( ) As you shoot at the score display, gradually reduce your television's contrast until no "hit" is registered. Then increase the contrast until a "hit" is just registered for the following adjustments.

NOTE: In the following steps, you will adjust the LDR so your gun will "shoot" accurately. DO NOT touch the "face" of the LDR in the following steps.

( ) Aim the gun at the score and pull the trigger. You should hear a "hit" tone generated.

( ) Repeatedly pull the trigger and move the gun to the right of the score. Note the distance to the right of the score that the hit is not registered.

( ) Repeatedly pull the trigger and move the gun to the left of the score. Note the distance to the left of the score that the hit is not registered.

( ) Adjust the LDR as directed in either A or B below.

A. If you have to aim your gun to the left, slightly move the LDR towards the circuit board.

B. If you have to aim your gun to the right, slightly move the LDR away from the circuit board.

( ) Repeat the preceding three steps until your gun shoots accurately.

( ) As before, repeatedly pull the trigger and move the gun above the score. Note the distance above the score that the hit is not registered.

( ) Repeatedly pull the trigger and move the gun below the score. Note the distance below the score that the hit is not registered.

( ) Adjust the LDR as directed in either A or B below.

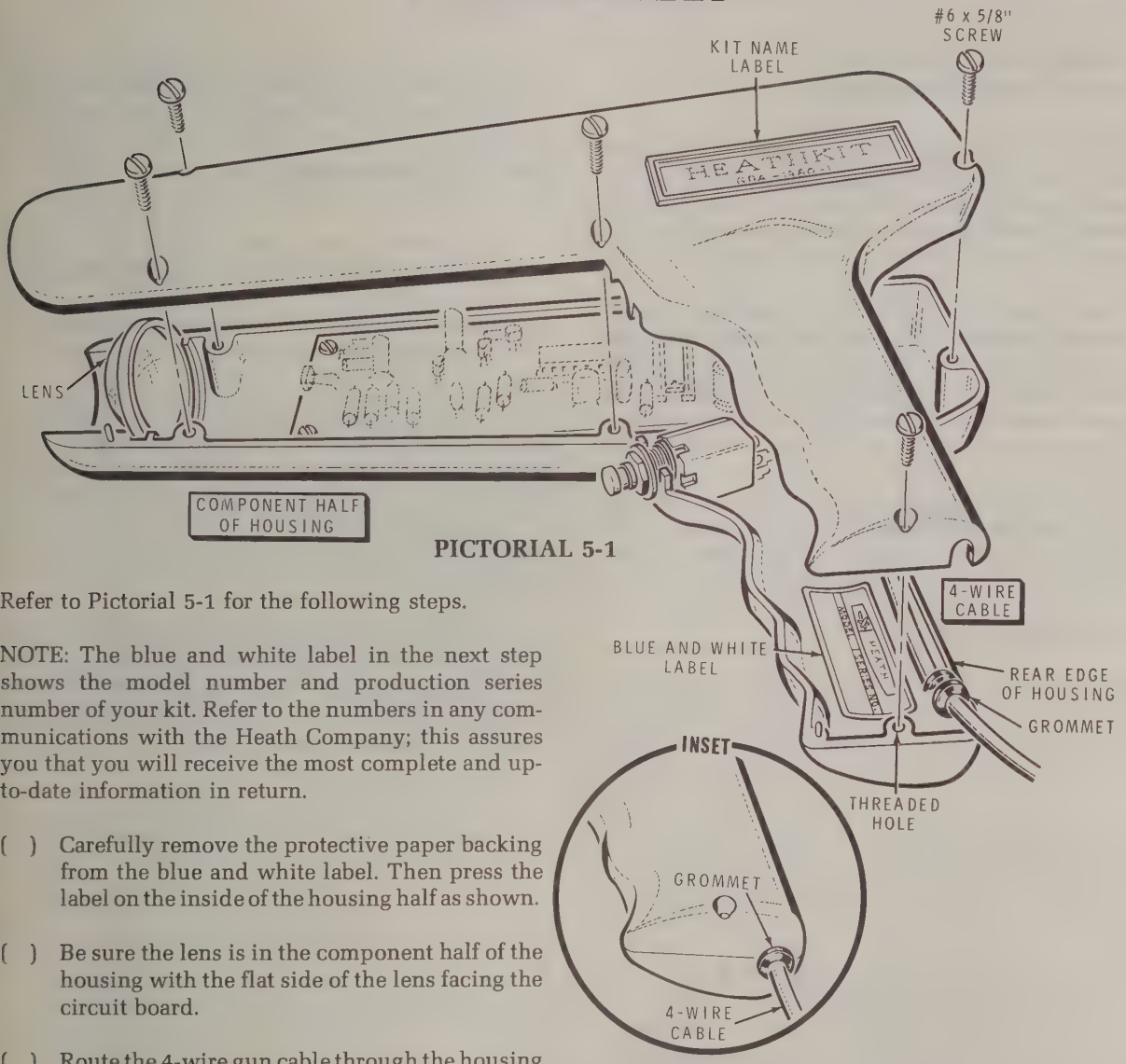
A. If you have to aim your gun low, slightly move the LDR towards the top of the gun barrel.

B. If you have to aim your gun high, slightly move the LDR towards the bottom of the gun barrel.

( ) Repeat the preceding LDR adjustments as necessary until your gun shoots accurately.

This completes the "Initial Test and Adjustment." Proceed to "Final Assembly."

FINAL ASSEMBLY



PICTORIAL 5-1

Refer to Pictorial 5-1 for the following steps.

NOTE: The blue and white label in the next step shows the model number and production series number of your kit. Refer to the numbers in any communications with the Heath Company; this assures you that you will receive the most complete and up-to-date information in return.

( ) Carefully remove the protective paper backing from the blue and white label. Then press the label on the inside of the housing half as shown.

( ) Be sure the lens is in the component half of the housing with the flat side of the lens facing the circuit board.

( ) Route the 4-wire gun cable through the housing handle as shown.

( ) Position the 4-wire gun cable and grommet in the cutout of the housing half as shown in the inset drawing. Be sure the housing cover is positioned so it matches the component half before performing the next step.

( ) Mount the housing cover to the component half as shown. Use five #6 × 5/8" self-tapping screws. Do not overtighten these screws.

( ) Carefully remove the protective paper backing from the kit model label. Then press the label in place in the recessed area of the housing as shown.

( ) In the same manner, install the remaining kit model label in the recessed area on the opposite side of the housing.

This completes the "Final Assembly." Proceed to "Operation."

OPERATION

TARGET 1 AND TARGET 2 (Video Game Selector Switch)

In the Target 1 game, the target travels from left to right across the screen, momentarily blanks from the screen, and reappears traveling from left to right again. In the Target 2 game, the target bounces randomly about the screen.

Touching the Reset Touchplate (on the Video Game) resets the score to 0. The score is then blanked from the screen until fifteen shots have been fired. Each time the target is hit, a hit sound is generated and the target is momentarily blanked from the screen. After fifteen shots have been fired, the score appears on the screen, indicating the game is over. The number of shots fired appears on the left and the number of hits appears on the right. If you continue to shoot at the target after the score appears, a hit sound will be heard, but no further scoring will be indicated.

GUN SENSITIVITY

The sensitivity of your Target Accessory is dependent upon the amount of ambient light, the intensity and size of the target, and the distance from the gun to the target. The intensity and size of the target are a function of the brightness and contrast control settings. CRT size, and anode voltage and current available. For maximum sensitivity, use the Target Accessory under the following conditions.

1. Low ambient light (dimly lit room).
2. Increase your television's contrast control for a bright display.
3. Decrease your television's brightness control for a dark background.

The Target Accessory will normally not respond to incandescent light or sunlight. However, when the gun is moved back and forth across such a light source, a single pulse is generated in the target circuit at the moment of transition from dark to light. If the trigger is pulled at the exact moment of transition, a hit will be indicated.

Fluorescent lights produce a very strong 120 Hz AC field. This AC field cannot be differentiated from the target by the target sensing circuit. Therefore, it may be necessary to turn off any fluorescent lights to obtain proper Target Accessory operation.

IN CASE OF DIFFICULTY

Begin your search for any trouble that occurs after assembly by carefully following the steps listed below in the "Visual Tests."After you complete the "Visual Tests," refer to the "Troubleshooting Chart."

NOTE: Refer to the "Circuit Board X-Ray View" (on Page 29) for the physical location of parts on the circuit board.

VISUAL TESTS

1. Recheck the wiring. Trace each wire in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the kit builder.

2. About 90% of the kits that are returned to the Heath Company for repair do not function properly due to poor connections and soldering. Therefore, you can eliminate many troubles by reheating all connections to make sure that they are soldered as described in the "Soldering" section of the "Assembly Notes." Be sure there are no solder "bridges" between circuit board foils.

3. Check to be sure that all transistors and diodes are in their proper locations. Make sure each lead is connected to the proper point. Make sure that each diode band is positioned above the band printed on the circuit board.

4. Check the values of the parts. Be sure in each step that the proper part has been wired into the circuit, as shown in the Pictorial diagrams. It would be easy, for example, to install a 5100 Ω (green-brown-red) resistor where a 51 kΩ (green-brown-orange) resistor should be installed.

5. Check for solder bits, wire ends, or other foreign matter which may be lodged in the unit.

6. A review of the "Circuit Description" may also help you determine where the trouble is.

If you still do not locate the trouble after you complete the "Visual Tests," and a voltmeter is available, check voltage readings against those shown on the "Schematic Diagram" (Illustration Booklet, Page 1). NOTE: All voltage readings were taken with an 11 MΩ input impedance voltmeter or the Troubleshooter meter. The meter used is indicated by the symbol enclosing the voltage reading. Voltages may vary as much as 20%.

In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

PRECAUTIONS FOR TROUBLESHOOTING

1. Be cautious when you test solid state circuits. Although they have almost unlimited life when used properly, they are much more vulnerable to damage from excessive voltage or current than tubes.

2. Be sure you do not short any terminals to ground when you make voltage measurements. If the voltmeter probe should slip, for example, and short across components or voltage sources, it is very likely to cause damage to one or more transistors or diodes.

SILICON BIPOLAR TRANSISTOR CHECKING

To check a transistor accurately, you should use a transistor checker. However, if one is not available, you can use an ohmmeter to determine the general condition of the transistors in this kit. The ohmmeter you use must have at least 1 volt DC at the probe tip to exceed the threshold of the diode junctions on the transistor being tested. Most vacuum tube voltmeters meet this requirement.

To check a transistor with an ohmmeter, proceed as follows:

1. Remove the transistor from the circuit.
2. Set the ohmmeter on the R X 1000 range.
3. Connect one of the ohmmeter test leads to the base (B) of the transistor. Touch the other meter lead to the emitter (E) and then to the collector (C). Both readings should be approximately the same, but may be either high or low. If one reading is high and the other low, the transistor should be replaced. (Identify the transistor leads on the Semiconductor Identification Chart on Page 30.)
4. Repeat step 3 with the test leads reversed.
5. Check the resistance from the collector to the emitter to make sure there is no short circuit.

NOTE: In the unusual case when the readings are all low, or all high, no matter which ohmmeter lead is connected to the base, the transistor should be replaced.

TROUBLESHOOTING CHARTS

This section of the Manual consists of a series of charts and tests that will help you locate the area of difficulty. The chart lists reactions that you can observe ("Results") using a DC voltmeter.

The chart sequence is arranged so that, if the indicated result is obtained for the first test, the entire circuit under test is operating properly.

( ) Connect the black test lead to switch SW1 lug 2.

( ) Refer to the chart and touch the red test lead to the indicated test point.

Trigger Circuit

The results indicated in this chart are obtained by pulling the trigger.

TEST POINT	RESULT	POSSIBLE CAUSE
Both leads of D2 and IC2C pin 8.	A slight positive pulse each time the trigger is pulled.	1. IC1B, IC2. 2. SW1. 3. D2, D3.
IC2A pin 3, IC1B pin 6, and IC1B pin 4.	Approximately 7V as long as the trigger is pulled.	1. IC2. 2. SW1.
IC2C pin 8.	Approximately 7V as long as the trigger is pulled.	1. SW1. 2. IC2.
IC2A pin 1.	0V as long as the trigger is pulled.	1. SW1. 2. IC2.

Target Sensing Circuits

The results indicated in this chart are obtained when a target is focused on the LDR.

While you perform these tests, the lens must be in place and the LDR must be shielded from ambient light. To shield the LDR, cup your hand over the edge of the lens and LDR area or tape a piece of thick paper over this area.

Since the score is electronically the same as the target, perform the tests while moving the gun from the dark area of the screen across the score.

TEST POINT	RESULT	POSSIBLE CAUSE
IC2C pin 9.	Approximately 7V.	1. IC1A, IC2. 2. Q1, Q2, Q3. 3. LDR1.
Q3 collector.	Approximately 1V.	1. Q1, Q2, Q3. 2. LDR1.
Q2 emitter.	Slight voltage increase.	1. Q1, Q2. 2. LDR1.
Q1 collector.	Very slight voltage increase.	1. Q1. 2. LDR1.
Junction of LDR1 and R1.	Voltage increase.	LDR1.

Trigger and Target Sensing Circuits

The results indicated in this chart are obtained when a target is focused on the LDR and the trigger is pulled. Use the score for the target.

TEST POINT	RESULT	POSSIBLE CAUSE
Both leads of D4.	Approximately 0.5V each time the trigger is pulled.	1. D1, D4. 2. IC1, IC2. 3. Q1, Q2, Q3.
Banded lead of D1.	Slight negative pulse.	1. IC1, IC2. 2. Q1, Q2, Q3.
Unbanded lead of D1.	Slight negative pulse.	1. IC1, IC2. 2. Q1, Q2, Q3. 3. D1.

SPECIFICATIONS

Sensitivity	Dependent upon ambient light and target intensity.
Power Requirements	.025 watts at 7 volts DC.
Cable Length	Approximately 9 feet.
Net Weight	10 ounces (311 grams).

The Heath Company reserves the right to discontinue products and to change any specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

Refer to the Schematic Diagram, (Illustration Booklet, Page 1) while you read this Circuit Description.

TARGET SENSING CIRCUIT

When the light from the target is focused by the lens on light dependent resistor LDR1, its resistance decreases; resulting in an increase in current through LDR1 and R1. The amount of resistance change of LDR1 is dependent upon the intensity of the target, the distance from the target, and the ambient light level. The ambient light level reduces the maximum resistance value of LDR1 when the target is not present, thereby limiting the LDR resistance variation available.

Since the target is a series of displays applied to the picture tube with each vertical field, LDR1 sees the target as a series of light pulses, resulting in a 60 Hz AC signal being developed across R1.

The AC voltage developed across R1 is coupled through C1 to the base of Q1. DC bias at the base of Q1 is provided by voltage divider R2 and R3. DC current is established by emitter resistor R4. The amplified signal is developed across collector resistor R5 and coupled to the base of emitter follower Q2 through C3.

DC bias at the base of Q2 is provided by voltage divider R6 and R7. Q2 emitter voltage, developed across R8, is coupled through R9 to the base of Q3. This voltage is sufficient to cause Q3 to be saturated. Therefore, the collector voltage at Q3 is approximately .2 volts. The negative half-cycle of the AC signal at the base of Q2 causes the voltage developed across R8 to decrease, bringing Q3 out of saturation. This provides a logic 1 pulse at the trigger input (pin 12) of IC1A.

IC1A is one half of a dual monostable multivibrator. When the trigger input (pin 12) rises to logic 1, the voltage at the output (pin 10) rises to logic 1 for a period of time determined by the values of R11 and C4. With the values chosen for R11 and C4, the output will stay at logic 1 for approximately 39 milliseconds. As long as the light from the target is focused on LDR1, a new trigger pulse will be generated approximately every 16 milliseconds. This fulfills the requirement for retriggering IC1A. Therefore, its output will remain at logic 1. The logic 1 output (pin 10) of IC1A is connected to one of the two inputs (pin 9) of NAND gate IC2C.

TRIGGER CIRCUIT

Switch SW1 is the gun trigger. Common contact V is connected to ground (logic 0). Normally-closed contact W and normally-open contact X are connected to the inputs of cross-coupled NAND gates IC2A and IC2B to prevent double triggering due to contact bounce.

In its normal state, contact V is connected to contact W and the input (pin 5) of IC2B is held at logic 0. With one input (pin 5) of IC2B at logic 0, its output (pin 4) must be logic 1, which is connected to an input (pin 2) of IC2A. The second, input (pin 1) of IC2A is held at logic 1 by pull-up resistor R14. With both inputs (pins 1 and 2) of IC2A at logic 1, its output (pin 3) will be at logic 0.

As the gun trigger is pressed, the connection between contacts V and W opens and the input (pin 5) of IC2B is pulled up to logic 1 by pull-up resistor R13. No other change takes place until contact V makes connection with contact X. The instant contact V connects with contact X, the input (pin 1) of IC2A becomes logic 0. Therefore, the output (pin 3) of IC2A and the input (pin 6) of IC2B become logic 1. With both inputs of IC2B at logic 1, its output (pin 4) and the second input (pin 2) of IC2A become logic 0. With one input (pin 2) of IC2A at logic 0, it becomes immaterial whether the other input (pin 1) is logic 0 or logic 1. Therefore, the output (pin 3) of IC2A will remain logic 1, even if the connection between contacts V and X momentarily opens due to contact bounce. When the trigger is released this procedure is reversed.

When the gun trigger is pressed, the logic 1 level at the output (pin 3) of IC2A is applied to the trigger input (pin 4) of monostable multivibrator IC1B. The logic 1 level at the input (pin 4) of IC1B generates a logic 1 level at the output (pin 6) of IC1B. R15 and C6 determine the duration (approximately 20 milliseconds) of the output pulse. This shot pulse is

coupled through D2 and the 4-wire gun cable to the shot input (pin 26) of the Video Game IC2. A logic 1 pulse at this input (pins 26 of IC2) updates the shot counter one shot and opens the hit input (pin 27 of IC2) to see if a hit has been made. The shot pulse is also applied to one input (pin 8) of IC2C.

HIT DETECTOR CIRCUIT

If the gun is pointed at the target when the trigger is pulled, both inputs (pins 8 and 9) of IC2C will be logic 1. Thus the output (pin 10) of IC2C will go to logic 0 and C5 will discharge through D1. The input (pin 12) of IC2D will then go to logic 0 and its output (pin 11) will go to logic 1. The output (pin 10) of IC2C will remain at logic 0 as long as both inputs remain logic 1 (approximately 20 milliseconds). When the output (pin 10) of IC2C returns to logic 1, C5 charges through R12 to a logic 1 level. The input (pin 12) of IC2D is now at logic 1 and its output (pin 11) returns to logic 0. The duration of the logic 1 hit pulse at the output (pin 11) of IC2D will be the duration of the shot pulse plus the charge time of C5 (approximately 70 milliseconds). This hit pulse is applied to the hit input (pin 27) of the Video Game, IC2 through D4. It is also applied to the shot input (pin 27) of the Video Game, IC2 through D3.

When both the shot and hit inputs of Video Game IC2 are logic 1, a hit sound is generated, the hit counter is updated one count, and the target is momentarily blanked from the screen. D2 is reverse biased when the shot pulse returns to logic 0. This prevents the hit pulse from getting back into the shot input (pin 8) of IC2C. D3 is reverse biased when only a shot pulse is present. This prevents the shot pulse from appearing at the hit output (pin 11) of IC2D.

The jumper wire between the sound output (pin 3) and the hit input (pin 27) of Video Game IC2 raises the hit input to logic 1 when hit sounds are generated in the four non-target games. This insures starting of the count down counter, which turns off the sound after 38 milliseconds. This jumper wire has been replaced by a diode (D3*), which performs the same function for the non-target games, while preventing the hit pulse from being coupled directly to the sound output.

D4 is reverse biased when logic 1 sound pulses appear at the hit input. This prevents the hit output of the gun from loading the sound output of the Video Game.

*This diode is in the Video Game.

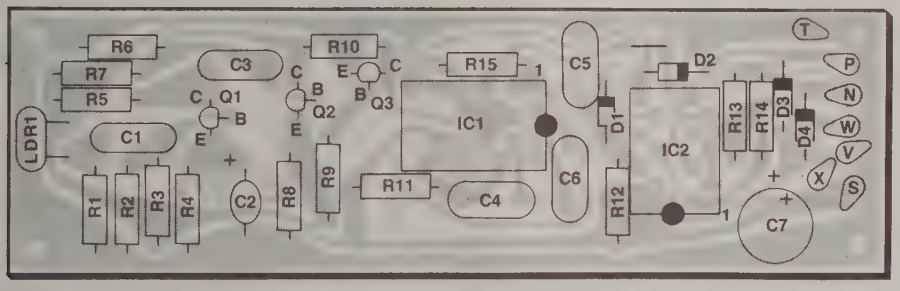
CIRCUIT BOARD X-RAY VIEW

NOTE: To find the PART NUMBER of a component for the purpose of ordering a replacement part:

A. Find the circuit component number (R5, C3, etc.) on the X-Ray View.

B. Locate this same number in the "Circuit Component Number" column of the "Parts List" in the front of this Manual.

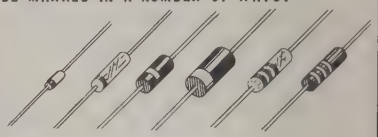
C. Adjacent to the circuit component number, you will find the PART NUMBER and DESCRIPTION which must be supplied when you order a replacement part.



(VIEWED FROM COMPONENT SIDE)

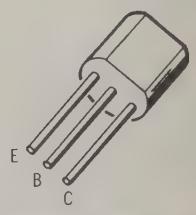
SEMICONDUCTOR IDENTIFICATION CHARTS

DIODES

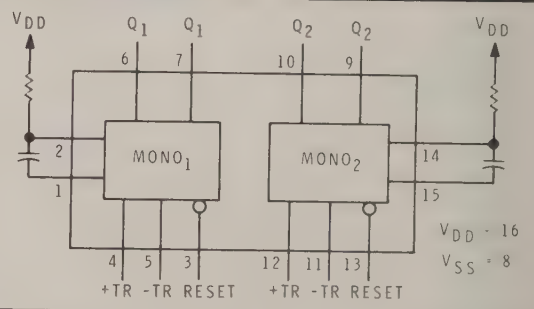
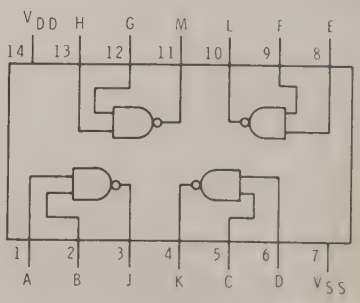
SCHEMATIC REFERENCE NUMBER	HEATH PART NUMBER	MANUFACTURER'S NUMBER	IDENTIFICATION DRAWING
D1, D2, D3, D4, D3*	56-56	1N4149	IMPORTANT: THE BANDED END OF DIODES CAN BE MARKED IN A NUMBER OF WAYS. 

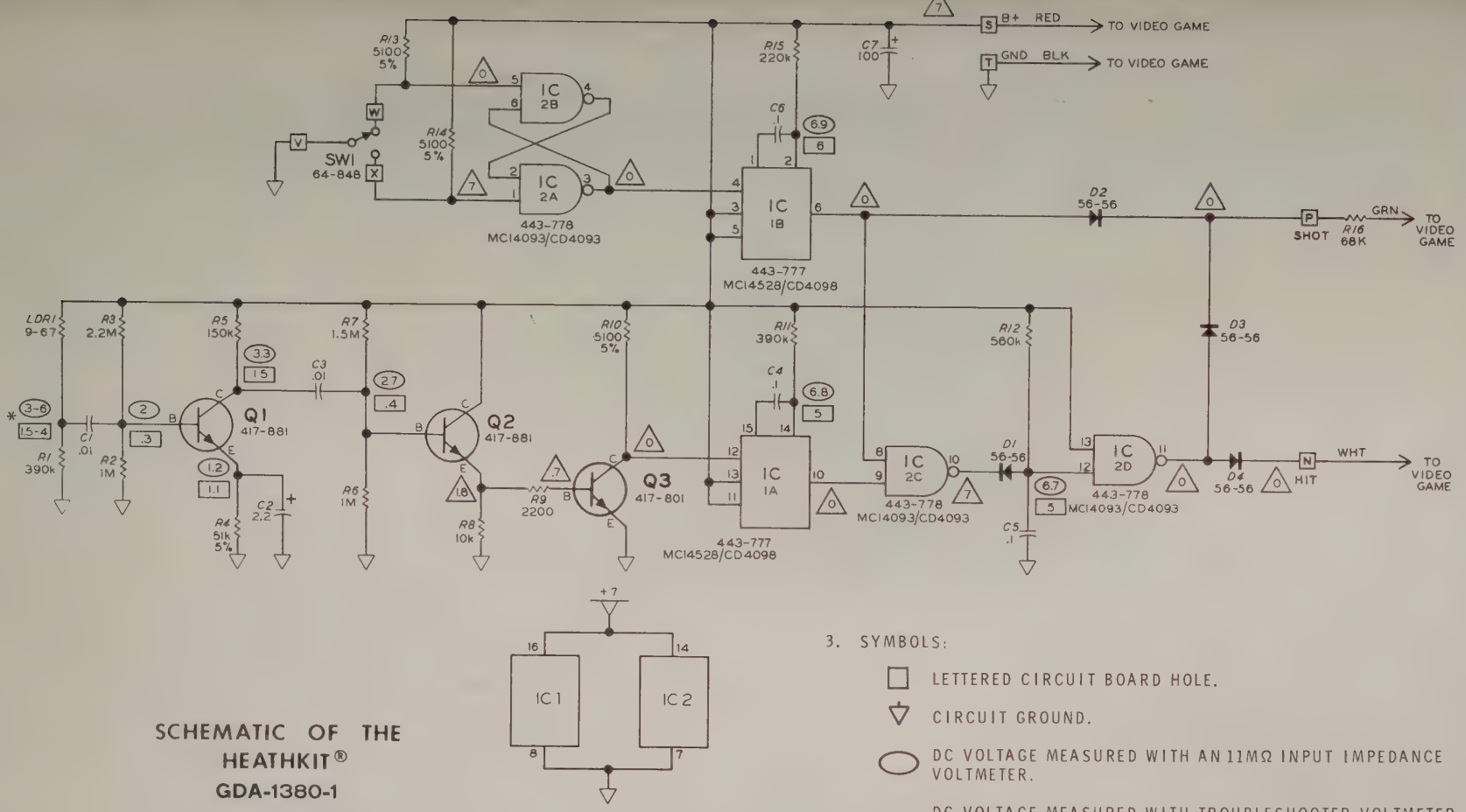
*Used in Video Game

TRANSISTORS

SCHEMATIC REFERENCE NUMBER	HEATH PART NUMBER	MANUFACTURER'S NUMBER	IDENTIFICATION DRAWING
Q1, Q2	417-881	MPSA13	
Q3	417-801	MPSA20	

INTEGRATED CIRCUITS

SCHEMATIC REFERENCE NUMBER	HEATH PART NUMBER	MANUFACTURER'S NUMBER	IDENTIFICATION DRAWING
IC1	443-777	MC14528 CD4098	
IC2	443-778	MC14093 CD4093	



SCHEMATIC OF THE HEATHKIT® GDA-1380-1 TARGET ACCESSORY

NOTES:

1. ALL RESISTORS ARE 1/2 WATT, 10% UNLESS SHOWN OTHERWISE. VALUES ARE SHOWN IN OHMS (k=1000, M=1,000,000).
2. CAPACITOR VALUES ARE SHOWN IN MICROFARADS.
3. SYMBOLS:
   - □ LETTERED CIRCUIT BOARD HOLE.
   - ▽ CIRCUIT GROUND.
   - ⬭ DC VOLTAGE MEASURED WITH AN 11MΩ INPUT IMPEDANCE VOLTMETER.
   - ▭ DC VOLTAGE MEASURED WITH TROUBLESHOOTER VOLTMETER. ANY VOLTAGE GREATER THAN 4 VOLTS IS MEASURED IN THE 50V POSITION.
   - △ DC VOLTAGE MEASURED WITH EITHER TROUBLESHOOTER OR 11MΩ INPUT IMPEDANCE VOLTMETER.
4. SW1 IS NOT MOUNTED ON THE CIRCUIT BOARD.
5. VOLTAGES MEASURED WITH SW1 IN THE NON-TRIGGERED POSITION AS SHOWN.
6. * VOLTAGE VARIES WITH AMOUNT OF AMBIENT LIGHT.

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, $3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

  Total enclosed $_____
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____ Invoice # _____

Date Purchased _____ Location Purchased _____

LIST **HEATH** PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE
TOTAL FOR PARTS			
HANDLING AND SHIPPING			
MICHIGAN RESIDENTS ADD 4% TAX			
TOTAL AMOUNT OF ORDER			

SEND TO: **HEATH COMPANY**
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUT ALONG DOTTED LINE

FOR PARTS REQUESTS ONLY

- Be sure to follow instructions carefully.
- Use a separate letter for all correspondence.
- Please allow 10 - 14 days for mail delivery time.

DO NOT WRITE IN THIS SPACE

INSTRUCTIONS

- Please print all information requested.
- Be sure you list the correct **HEATH** part number exactly as it appears in the parts list.
- If you wish to prepay your order, mail this card and your payment in an envelope. Be sure to include 10% (25¢ minimum, $3.50 maximum) for insurance, shipping and handling. Michigan residents add 4% tax.

  Total enclosed $_____
- If you prefer COD shipment, check the COD box and mail this card. COD ☐

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

The information requested in the next two lines is not required when purchasing nonwarranty replacement parts, but it can help us provide you with better products in the future.

Model # _____ Invoice # _____

Date Purchased _____ Location Purchased _____

LIST **HEATH** PART NUMBER	QTY.	PRICE EACH	TOTAL PRICE
TOTAL FOR PARTS			
HANDLING AND SHIPPING			
MICHIGAN RESIDENTS ADD 4% TAX			
TOTAL AMOUNT OF ORDER			

SEND TO: **HEATH COMPANY**
BENTON HARBOR
MICHIGAN 49022
ATTN: PARTS REPLACEMENT

Phone (Replacement parts only): 616 982-3571

THIS FORM IS FOR U.S. CUSTOMERS ONLY
OVERSEAS CUSTOMERS SEE YOUR DISTRIBUTOR

CUSTOMER SERVICE

REPLACEMENT PARTS

Please provide complete information when you request replacements from either the factory or Heath Electronic Centers. Be certain to include the **HEATH** part number exactly as it appears in the parts list.

Replacement parts are maintained specifically to repair Heath products. Parts sales for other reasons will be declined.

ORDERING FROM THE FACTORY

Print all of the information requested on the parts order form furnished with this product and mail it to Heath. For telephone orders (parts only) dial 616 982-3571. If you are unable to locate an order form, write us a letter or card including:

- Heath part number.
- Model number.
- Date of purchase.
- Location purchased or invoice number.
- Nature of the defect.
- Your payment or authorization for COD shipment of parts not covered by warranty.

Mail letters to: Heath Company
Benton Harbor
MI 49022
Attn: Parts Replacement

Retain original parts until you receive replacements. Parts that should be returned to the factory will be listed on your packing slip.

OBTAINING REPLACEMENTS FROM HEATH ELECTRONIC CENTERS

For your convenience, "over the counter" replacement parts are available from the Heath Electronic Centers listed in your catalog. Be sure to bring in the original part and purchase invoice when you request a warranty replacement from a Heath Electronic Center.

TECHNICAL CONSULTATION

Need help with your kit? — Self-Service? — Construction? — Operation? — Call or write for assistance. you'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek — please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase and invoice number.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit COD for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment. Do not include the kit Manual.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH

Schlumberger

MP MASTER

MA22818

HEATH COMPANY • BENTON HARBOR, MICHIGAN

THE WORLD'S FINEST ELECTRONIC EQUIPMENT IN KIT FORM

LITHO IN U.S.A.